Volatile Organic Compounds in Serum or Plasma

Application Note

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Introduction

The analysis of alcohols in blood (plus acetaldehyde and acetone) is demonstrated in this application note. Testing for the presence and subsequent quantification of ethanol in serum and plasma is often performed in forensic and toxicology laboratories. In addition to the ethanol, analysis of other alcohols, as well as acetaldehyde and acetone, is necessary.

Ethylene glycol, for instance, is widely used as a solvent or surfactant. It is also used as a nonfreezing compound in coolants for cars. There are cases of accidental and suicidal ingestion of such materials. Toxic actions of ethylene glycol are the suppression of central nervous system activities and metabolic acidosis caused by glycolic acid produced from ethylene glycol. The glycolic acid is further metabolized into oxalic acid, which binds with calcium ions to form the insoluble salt; the salt precipitates in various tissues. This sometimes causes renal dysfunction.

A sensitive and reproducible gas chromatographic method for ethanol and other volatile organic compounds in serum or plasma was developed using the polar CP-Wax 52 CB column, creating good peak shapes; this can also be seen for ethylene glycol. The method involves direct injection of the biological specimen into the GC, with little pre-treatment (plasma is mixed with internal standard solution and injected).

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Sample Preparation

The blood samples were collected in anti-coagulant (EDTA) containing tubes, closed and centrifuged for 5 minutes at 3000 RPM. 100 µL plasma was taken, mixed with 100 µL internal standard solution and stored in a closed micro sample container.

Calculation

The ethanol concentration of plasma is 1.17 times the concentration in whole blood, so the calculated value for plasma must be corrected by this factor to find the concentration in whole blood.

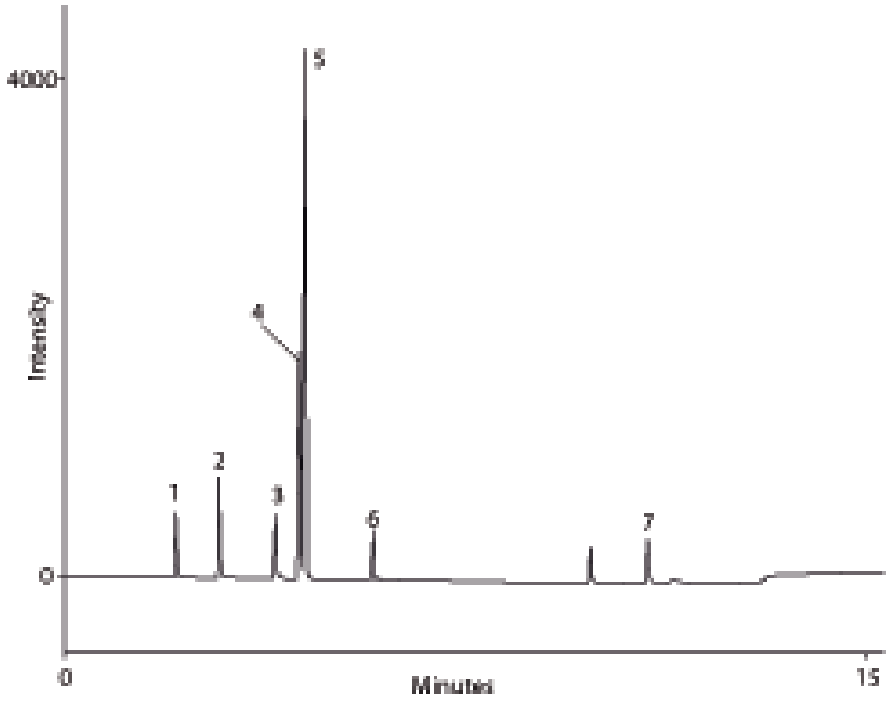
Conditions

Sample:	KKGT[1] reference sample
Column:	CP-WAX 52 CB, 0.25 mm x 30 m: 0.5 µm (part number CP8746)
Temperature:	40 °C (4 min) ⟶ 210 °C, 15 °C/min
Carrier Gas:	Nitrogen
Flow Rate:	1.46 mL/min
Pressure:	100 kPa (1.0 bar, 14 psi)
Injector:	Split, 1:25, split/splitless liner without glass wool, with carbon frits, 230 °C
Inj Vol:	0.2 µL
Sample Conc:	Acetaldehyde 0.775 g/L, Acetone 0.704 g/L, Methanol 0.652 g/L, Isopropanol 1.435 g/L, Ethanol 3.233 g/L, Ethylene glycol 0.843 g/L, 1-Propanol (I.S.) 0.333 g/L in water. Detection limit for methanol and ethanol 0.1 g/L
Detector:	FID, 250 °C

[1] Kwaliteitsbewaking Klinische Geneesmiddelanalyse en Toxicologie (Association for Quality Assessment in Therapeutic Drug Monitoring and Clinical Toxicology).

Table 1. Peak Identification for Figure 1

Peak	Identification	Retention Time (min)
1	Acetaldehyde	2.07
2	Acetone	2.88
3	Methanol	3.93
4	Isopropanol	4.37
5	Ethanol	4.47
6	1-Propanol (I.S.)	5.77
7	Ethylene glycol	10.95



Analysis of organic compounds in blood plasma

Remarks

The carbon fritted liner acts as a kind of trap to prevent column contamination and is cleaned or changed regularly to prevent decreasing of the performance, typically after about 50 injections.

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